

Zero Retries issue 0123 2023-11-03

Zero Retries is an independent newsletter promoting technological innovation in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Now in its third year of publication, with 1000+ subscribers.

About Zero Retries

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor Emeritus

In this issue:

- Request To Send
- My Feedback to Radio World for Their Recent Article on Amateur Radio
- EMCOMM: An Amateur Radio Robust Alarming System
- SDR / 10 GHz Data Downlink, PacSat Project, and CubeSatSim - From 2023 AMSAT Space Symposium
- Repurposed Portable Light Towers for Amateur Radio
- Recommendations on Inexpensive Generic Data Radios
- ZR > BEACON
 - Application Period for 2024 ARDC Committees Extended to 2023-11-08
 - Not Everyone is a Fan of Eliminating Symbol Rates in Amateur Radio
 - New APRS / SMS Gateway
 - 44Net VPN Servers?
 - GNU Radio Conference 2023 Individual Talks Posted
 - inovato Embraces Amateur Radio (Products)
 - digirig Offers Nice Cables for Portable (and Other) Radios
 - NinoTNC Version Update - x.31
- Join the *Fun* on Amateur Radio
- Closing The Channel

Web version of this issue - <https://www.zeroretries.org/p/zero-retries-0123>

Request To Send

Commentary by Editor Steve Stroh N8GNJ

New Paid Subscribers

My thanks to new Paid Subscriber “Prefers to Remain Anonymous 16” for their financial support of Zero Retries.

My thanks to new Paid Subscriber Peter Neubauer KD0QXJ for his financial support of Zero Retries.

Financial support is a real vote of confidence for continuing to publish Zero Retries.

Welcome (Many) New Subscribers (From Nice Mention in Radio World)

Lately, the Zero Retries subscriber count is ticking up significantly, likely from a nice mention in Radio World (... the leading news and career resource for broadcast radio owners, managers and engineers all over the world.) on 2023-10-27 by Randy J. Stine - [FCC Wants to Bolster Amateur Radio](#):

Steve Stroh, editor of amateur radio newsletter Zero Retries, says the need for improved data communications in amateur radio also coincides with spectrum becoming more “noisy” due to “pollution” by systems such as LED lighting, small switching power supplies and even solar panels.

“That noise has an outsize impact on analog modes such as voice and very low power transmissions. Improved data communications modes, including digital voice modes, can overcome the noise issues,” Stroh said in an email to Radio World.

Stroh says he is happy to see the FCC address the same limitation on the amateur radio VHF and UHF bands — where there is arguably much greater potential for technological innovation in data communications technology — if it wasn’t for the data rate and mode limitations.

“Fortunately, in its proposal, the FCC recognizes that the symbol rate and mode issue does include the Amateur Radio VHF and UHF bands. Thus the FCC’s proposal is a very good one that will significantly benefit Amateur Radio,” he said.

I was a bit surprised to see that Stine focused more on the noise quote than much of the rest of my commentary (see the story below), but I guess that served the story best. It was kind of cool to be mentioned in the same article as a quote from the ARRL.

Family Status, Publishing Zero Retries On Schedule (and Sometimes Not)

Only reluctantly do I mention family and personal issues here in Zero Retries. My perspective is that you’re reading Zero Retries to learn about Technological Innovation in Amateur Radio, not about the mundane events in my household. In Zero Retries 0122, I referenced

... some personal issues that have consumed almost the entire week

as explanation for Zero Retries unusually publishing late, and (at least in my mind) a bit incomplete. My family took me to task a bit for that terse explanation and told me it’s reasonable for a bit more explanation, which is that my wife Tina had hip replacement surgery last week. There were some mild complications that (unexpectedly) consumed the week. Tina is doing fine, recovering nicely, and she’s already at that magical point of such surgeries where, in recovery, she’s in less pain and has more mobility than before the surgery.

I *had* planned ahead for that busy week for Zero Retries 0122 to some extent and only had a few last-minute small items to add to Zero Retries 0122. But, when the major Zero Retries Interesting news about the FCC November Open Meeting dropped, *that* really necessitated an additional, timely article.

Brief Starlink Update for N8GNJ Labs

Starlink continues to be *the* Internet connection in N8GNJ Labs and my office where I do the majority of writing of Zero Retries. Even with my marginal “expedient installation”, Starlink continues to perform well. I have the Starlink Network Statistics web page (generated internally by my “Dishy McFlatface”) displayed in the corner of my display, and it’s interesting to note that Starlink ramps its data rate up and down depending on what I’m doing. If I’m editing Zero Retries, the data usage is low (Substack’s only editing is via a web-based editor), and the download data rate is correspondingly low. But if I’m downloading files, the download data ticks up. This makes sense considering that I’m sharing spectrum and resources with all the other Starlink users in a Starlink satellite’s footprint as they pass overhead, and a ground station or two.

It’s kind of mind-blowing (to me anyway...) to go to <https://satellitemap.space>, select Starlink, and see just how many Starlink satellites are providing Broadband Internet Access from space, and knowing that *all my Internet activity is via satellites!* SpaceX is now launching [Starlink v2 Mini sats](#) with improved radio technology (until they can launch the “full size” v2 satellites on the still-in-development Starship rocket). Starlink also suffers from using kind-of-marginal [Carrier-grade Network Address Translation \(CGNAT\)](#) for IPv4 services. In mid-2023, Starlink apparently enabled IPv6 to all customers, but their older routers do not support IPv6 (to be determined if mine does, or doesn’t). That will be an interesting science project in the coming months to enable IPv6 (which per some reports does not block incoming ports like CGNAT does).

The Prescient Lyle Johnson KK7P

In Zero Retries 0037 - Banquet Speech by Lyle Johnson WA7GXD I told the story of being in attendance at... now that I think about it, *the best speech about Amateur Radio that I’ve ever heard*, (then) WA7GXD (now KK7P) was the banquet speaker at the ARRL and TAPR 1996 Digital Communications Conference in Seattle Washington, USA on September 21, 1996. In text, it’s a quick read. In the wake of the FCC’s decision to eliminate symbol rates from Amateur Radio HF bands¹, I marvel at this prescient statement by KK7P:

My feeling of how Part 97 should read is easy — “Here's your band limits. Have a nice day.” I think we could fit the whole of Part 97 on this side of this three by five card in large type. So that even a bifocal guy like me could read it without glasses.

That echoes my perspective on this issue. More accurately, KK7P’s foresight helped me develop *my* perspective on this issue.

Direct VHF / UHF RF to / from Digital - We’re Finally *There!*

One of the many great talks recently released as part of GNU Radio Conference 2023 was “Analog Devices Sponsored Talk - Direct RF Managing the extreme”.

I muttered an expletive (startling my wife) when the presenter said that Analog Devices now offers components that can do direct RF sampling (and generation) for frequencies all the way up to [X-band](#) (7.0 - 11.2 GHz). “Everyone” who follows Software Defined Radio technology knew we would eventually reach this point... but now... it’s... *here!* For VHF / UHF radios we no longer need analog radio technology such as downconverters, intermediate filter stages, mixers, etc. We’re finally at the point that *a radio for VHF / UHF is RF in, digital out, process in software*. This probably isn’t quite “practical” for *Amateur Radio* quite yet - the components are undoubtedly expensive, and the data rates for those frequencies are considerable, and thus require significant compute power. But... damn... *we’re finally to the point where it’s possible!*

73,

Steve N8GNJ

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My Feedback to Radio World for Their Recent Article on Amateur Radio

By Steve Stroh N8GNJ

*This is my full response to Radio World for their article **FCC Wants to Bolster Amateur Radio**. See Request To Send above for the “pull quotes” that they decided to use. Their deadline was end of day of the day I received their query. As I wrote this, I had not been able to study, in depth, what the FCC said.*

Apologies that this will be a limited response as your query and deadline came on a day that I’m in my wife’s hospital room with only my phone. Thus I don’t have access to most of my reference materials. Given your deadline, I’ll do my best here with just my phone.

The ARRL’s original request to the FCC was a good one, seeking elimination of an outdated limitation of data rate and specified modes in the Amateur Radio HF bands. Unfortunately the ARRL’s proposed changes ignored the same limitation on the Amateur Radio VHF and UHF bands, where there is arguably much greater potential

for technological innovation in data communications technology, if it wasn't for the data rate and mode limitations.

Fortunately, in its proposal, the FCC recognizes that the symbol rate and mode issue does include the Amateur Radio VHF and UHF bands. Thus the FCC's proposal is a very good one that will significantly benefit Amateur Radio.

The primary reason I started my newsletter Zero Retries is that it's poorly recognized just how much technological innovation IS occurring in Amateur Radio in this era. The major driver of this innovation is the combination of powerful and inexpensive compute power (such as the newest generations of Raspberry Pi computers with multi-GHz clock speeds), high speed A/D and D/A converters, and easy to use open source digital signal processing libraries. There are several examples of this powerful combination realized to the point that a radio transmitter can literally be as "simple" as a computer with an antenna attached.

Simultaneously with these new data communications technologies has come the preference, and the need for improved data communications in Amateur Radio. In very broad strokes, the current generation doesn't enjoy "talking with random folks" as much as previous generations did, and are more comfortable with and often prefer using text modes (data communications).

The need for improved data communications in Amateur Radio is that the radio spectrum has become more "noisy" due to "pollution" by systems such as LED lighting, small switching power supplies ("wall warts"), and even solar panels. That noise has an outsize impact on analog modes such as voice and very low power transmissions. Improved data communications modes, including digital voice modes, can overcome the noise issues.

These technologies have shifted the momentum of development of radio technology from hardware to "mostly software". This has been the case for decades in commercial and military radio systems, but now this trend has expanded to the realm of hobbyists like Amateur Radio.

We now have numerous Software Defined Transceivers that "deal with the hard parts of radio" and allow experimentation by "just bring software". While these SDTs aren't limited to Amateur Radio, what is unique and important about SDTs used in Amateur Radio is that using them with an Amateur Radio license is that an Amateur Radio license is literally a license to experiment with new radio technology, including being able to transmit at significant power levels. To do similar experimentation in other radio services requires a waiver from the FCC (Part 5 Experimental license or Special Temporary Authority).

This inherent capability for radio technology experimentation is becoming more widely recognized by those in the technology industry. New Amateur Radio operators are getting licensed at DEF CON and other (non Amateur Radio) technology conferences solely to be able to get hands-on experience with radio technology.

Specific to the FCC proposal, the technologies mentioned previously are making it *possible* for higher speeds and higher reliability data communications on Amateur Radio VHF and UHF bands. But, to date, that potential is largely unrealized as most developers considered the symbol rate limitations on the Amateur Radio VHF and UHF bands to be insurmountable, and thus not worth investing their efforts.

This resulted in the development of high speed Amateur Radio data networks to date largely being relegated to the Amateur Radio microwave bands (where there never have been any symbol rate limitations). But microwave bands have the significant limitation of requiring optical line of sight paths - one tree in a microwave link impacts or blocks the link.

But VHF and UHF do not suffer from that "link blockage" effect, and thus can be an effective complement to microwave links... *if* the speeds on VHF and UHF can be commensurate with the effort of building such systems and networks.

Soon... we'll be able to do so. On behalf of Amateur Radio, Thank You FCC for updating Amateur Radio's regulations to enable the use of the technologies of the 21st Century.

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EMCOMM: An Amateur Radio Robust Alarming System

By Alexander von Obert DL4NO
Munich, Barvaria, Germany

DL4NO and I regularly trade emails about Zero Retries Interesting subjects, and this is his latest Zero Retries Interesting idea that I wanted to share with Zero Retries readers. - Editor

While most EMMCOMM projects try to provide quite some bandwidth for mail, voice or even video, I see quite some potential for very low-bandwidth systems.

You might remember my idea to combine [LoRa](#) or [VARA](#) with [FIDOnet technology](#). For mail traffic over narrow channels this is a much better solution than the extremely “chatty” Internet technology. For such a station you could build a box with a data transceiver, a smaller Raspberry Pi and a solar power system with batteries. Perhaps add a better [Wireless Local Area Network - WLAN] adapter than the Raspi has and a GPS receiver. The box provides an open WLAN that opens a Web browser window on the user's smartphone, that allows to create accounts and then email traffic.

Such a system does not rely on line of sight paths like [AREDN](#). The central node(s) could distribute information to the Web browsers in the boxes distributed over the disaster areas. The mail accounts are automatically tagged with a position that can for example be used as a life sign. Data traffic over the air gap could easily be below 1 kB/mail.

My new idea: How to alarm helpers in grid-down situations. This idea centers on another box, that contains a Raspberry Pi, an appropriate battery power supply, a loud buzzer and a shortwave data transceiver like a [QDX](#), that can do [JS8Call](#). JS8Call already contains more or less all functions needed. But the JS8Call API is more or less undocumented up to now.

The basic idea: Every potential helper installs such a box at home and connects it to his WLAN. Normally, a pure receiving antenna is sufficient. The central node of the system sends out regular group calls. The boxes reply to these group calls over the Internet - this is why they need the WLAN connection. If a box does not reply, the personal at the central node is automatically informed. Test alarms with the buzzer are also possible so everyone in the helper's household knows what the noise is all about.

In an emergency, the helper is alarmed by the buzzer. He takes his smartphone or so and connects to the Raspberry Pi. KM4ACK has written scripts that connect a Raspi to a WLAN. When the WLAN disappears, the Raspi switches to access point mode. This way the connection also works in an off-grid situation. JS8Call messages advice the helper what he should do in this specific situation. That might even mean that he connects a better antenna so he can contact the central node.

This idea came up when I discussed in a regional EMMCOMM group. [DARC](#) is building trailers that contain all you need to provide phone services with AREDN means. I personally think that this is a bad idea for several reasons like deployment over larger distances during disasters and the need of quite some trained hams with on-call duty. Up to now they have no alarming scheme that would work in an off-grid situation.

This alarming scheme would be a unique feature that hardly any other service can provide.

I prefer a completely different approach: DARC has more than 1,000 local chapters. If something happens, there are always radio amateurs around. I would try to enable as many hams as possible to prepare for EMMCOMM on 2m/70cm FM, including repeaters that can operate off-grid for at least two weeks. Additionally, they should network with local authorities. For example I offered our local fire brigade, which has been a part of local life for 150 years, to organize workshops for the local population on how to use license-free handytalkies. Up to now I got very little response. But in an emergency some key people know that I can do something with wireless communication and where I am.

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Image courtesy of AMSAT

SDR / 10 GHz Data Downlink, PacSat Project, and CubeSatSim - From 2023 AMSAT Space Symposium

By Steve Stroh N8GNJ

My impressions of the most interesting projects discussed at the recent 2023 AMSAT Space Symposium.

Reference - [Presentation Schedule of the 2023 AMSAT Space Symposium](#)

As I mentioned in Zero Retries 0122 last week, I watched the presentations of the 2023 AMSAT Space Symposium as I had time available. I took the time to watch the the presentations below again, taking notes, and I remain interested and impressed.

Before I discuss these projects, I *do understand that these projects don't exist in a vacuum*²; they're not (intended as) "standalone" projects. For these projects to realize their *ultimate* goals, they are merely elements of a fund / design / build / launch / operate ecosystem *all of which requires attention and support*. As in, if I want to see these projects succeed, it's necessary to support AMSAT in general, not just contribute financially (and otherwise) to these specific projects.

That said, *these* AMSAT projects have peaked *my* interest when current satellites such as flying repeaters, while interesting overall, don't quite peak my personal interest.

I hope that AMSAT posts the slide decks for each of the presentations as there's a lot of good detail in them that flashes by too fast at times in the videos.

GOLF-TEE SDR / 10 GHz Data Downlink

[Presentation \(YouTube\)](#)

This experiment's primary goal is to provide a higher capacity downlink, using the Amateur Radio 10 GHz band. This improvement was requested for various payloads that need more data transfer capability than the current AMSAT data downlink systems can provide. Apparently the most expedient way to implement higher-speed data on 10 GHz is to integrate a mature, off-the-shelf, well understood and supported Software Defined Transceiver - an [Ettus Research USRP E310](#). AMSAT apparently plans to encapsulate this unit into a future satellite as-is - case, connectors, and all.

But, having a Software Defined Transceiver, especially one so well supported by GNU Radio, in orbit, can enable all manner of experiments that are possible with Software Defined Radio technology. One limitation might be how much access the E310 will have to the various antennas, etc. At the moment, AMSAT seems to be planning only for the E10 to be a 10 GHz transmitter. Given 10 minute passes, I'll guess that providing a software upload to this unit (especially given the overhead of GNU Radio), will take some time. Or perhaps they'll just switch the 10 GHz antenna to one of the receiver inputs and upload via 10 GHz.

PACSAT Update and Demonstration

[Presentation \(YouTube\)](#)

PacSat is a payload (single "1U" board) for a future AMSAT satellite that has a dual function - dual band digipeater, and an orbital Bulletin Board System (BBS) that can receive a BBS message in one portion of its orbit, and later transmit that BBS message in another portion of its orbit.

Previous PacSat payloads have been orbited, but this newest PacSat implementation takes advantages of "current" technology to be small and compact onto one board. The radios (chips) are the [On Semiconductor AX5043](#) (which has apparently been discontinued by the manufacturer).

Notably the PacSat Project is being developed as open source - it's claimed³ that all details are on GitHub - [PacSatSW](#) and [PacSatDocs](#). There is also a [publicly accessible mailing list for PacSat development](#).

The AX5043 radios have configurable radio functions (but are not "software defined"). PacSat will provide four receivers and one transmitter. The receivers will operate in the 144-148 MHz (2 meters) band and the transmitter will operate in the 420-450 MHz band (70 centimeters) band. Initially the receivers will be configured for 1200 bps Audio Frequency Shift Keying (conventional packet) and the transmitter will be configured for 9600 bps (format not stated, but likely the [G3RUH standard](#)). That the data rates, formats, etc. can be changed by reconfiguring the radio parameters such as data rates.

After the presentation, while setting up the demo, one of the attendees said this (from the YouTube transcription, cleaned up a bit):

I'm the youth initiative guy and I am so excited about this for engaging kids because kids don't talk today, they text. In working with the students at the University of Arizona I can't tell you how many times we've had them out in the field and they move from [Acquisition of Signal - AOS] to [Loss of Signal - LOS] holding their handheld waiting for an opening in the chatter.

They feel rude, you know, trying to break in. But you sit these kids down with a tablet and some kind of sound interface to a handheld they go crazy. I mean they, we, miss Bob Bruninga's [WB4APR] Pacsats and APRS sats so much. The kids had so much fun with that I can't wait to see this fly.

(Count me as one of those kids, at least from my interest.)

In the entire presentation and demo there was no mention of the specifics of the capabilities of the PacSat board, such as how much storage for messages will be available. The only reference to the storage size was "... a

pretty good chunk of memory”. That’s a critical detail.

Not mentioned, but one big advantage of 2020s technology versus earlier PacSats is that Forward Error Correction (FEC) for uplinks and downlinks is now “easy”, especially now that [Improved Layer 2 Protocol \(IL2P\)](#) is now in use for terrestrial Packet Radio, and is now easily accessible as one of the features of [Dire Wolf 1.7](#).

Admittedly the following speculation is out of scope for the AMSAT PacSat project, more appropriate for later discussion, but I feel AMSAT is missing a key attribute about the PacSat project. *This* implementation of PacSat, with fully developed hardware and software and the entire system being released as open source, could be adapted as a terrestrial system that would provide a “plug and play” BBS system somewhat akin to using the “MicroBBS” built into Kantronics TNCs. Of course, there’s the issue of that the AX5043 radio chip is no longer in production, but for terrestrial use, a bigger radio is probably more appropriate anyway, and with no space or power constraints, perhaps something like KA9Q’s ka9q-radio project could be used as a receiver system. There’s a lot of utility in a BBS system for Amateur Radio use, and BBS’ gradually fell out of widespread use because of channel congestion, slow speeds, simple “terminal” interfaces, etc. All of those individual issues have been quietly improved over the past decades, it’s just that no one has quite yet reimaged a Packet Radio BBS for the 21st Century.

CubeSatSim Update and Demonstration

[Presentation \(YouTube\)](#)

[CubeSatSim](#) (Simulator) is an actual “satellite” that is functionally similar to an AMSAT CubeSat, including size, but built with inexpensive (as opposed to expensive, space-qualified) parts. CubeSatSim is designed as an educational project and demonstrator. CubeSatSim transmits simulated telemetry (or in some cases, actual telemetry such as temperature, solar panel voltage, accelerometer, etc.) for learning how to receive CubeSat data with real data transmitted via radio (useful for develop the “ground station” package of radio, modem, software, integration, etc.).

CubeSatSim is designed to be constructed by amateur builders including students, and is designed to be “buildable” including details of the frames that can be built on a 3D printer. CubeSatSim’s ultimate goal is (my interpretation) is to get students, makers, and even Amateur Radio Operators “more comfortable, familiar, and interested” with satellite operation and specifically CubeSats. Along the way, you can’t help but understand more about space and physics - orbits, zero gravity, solar power budgets, etc. Generally, if you understand “the other end of the contact”, it’s more fun and you’re more motivated to get on the air with Amateur Radio satellites.

The design of CubeSatSim has evolved and improved considerably in the few years since the original implementation. The improved version (v1.3 Beta / v2) described in this presentation includes improvements such as:

- Uses components / subsystems that are more readily available (due to the ongoing shortages of certain electronic components).
- Use of a Raspberry Pi Pico microcontroller and Raspberry Pi Zero4 which is / are more easily programmed via Python using USB or Wi-Fi (presents as a drive, just drag your code modules into the “drive”).
- Improved and simplified power system, including option of USB-C for easier battery charging.
- Uses smaller, less expensive, more readily available solar panels.
- Use of NiMH batteries as a safer (than Li-ion) option for amateur assemblers; can be shorted with no fire danger. (It’s not clear if this is a new, or existing feature.)
- Uses a *frequency-stable* FM transmitter that provides more reliable decoding for APRS transmissions.

- There will be a Surface Mount Technology (SMT) board(s) option that could be supplied assembled and tested. (Earlier CubeSatSims were a blank PCB and a Bill of Materials).
- Designed for optional use as a balloon payload.
- Ground station software can be as easy as Fox-in-a-Box bundle on a (bootable) Raspberry Pi SD card (Raspberry Pi 4 recommended).

Conclusions

To my disappointment, but not unexpected given my research on the subject this year, was any mention of Amateur Radio satellites for Geosynchronous Earth Orbit / Geostationary (GEO) over the Western hemisphere. More realistically, such a project will likely be an Amateur Radio *payload* on a commercial or government GEO satellite. To me, this bolsters my conclusion that the most realistic path to a Amateur Radio GEO payload will be to bypass AMSAT and create an organization and project solely focused on that goal.

While my “most favorite satellite” would be a GEO satellite, with these projects, I’m getting a lot more interested in Amateur Radio satellites, and AMSAT as a builder / “launcher” / operator of such satellites. Simply put, these specific projects / and general direction (more data capabilities) are all Zero Retries Interesting (to me). Since they’ll all be Low Earth Orbit satellites, and thus require active tracking, it’s time to start working on that portion of my Amateur Radio station.

I could easily see the newest **CubeSatSim** becoming a “must have” accessory for a well-equipped Amateur Radio station, especially for Amateur Radio Operators that demonstrate Amateur Radio. (I really have to get back to work on my CubeSatSim, especially since my friend Randy Robinson N7EBB has helped me by building a 3D printed frame for me.)

As for the **GOLF-TEE SDR / 10 GHz Data Downlink** project, I think that will become a very popular satellite for advanced experimenters once it is in orbit. A 10 GHz ground station used to be challenging, but Software Defined Receivers that work up to (and beyond) 10 GHz are widely available and reasonably priced. It will be interesting to see if the Icom IC-905 with the (optional, but well-integrated) CX-10G transverter will be suitable as a high speed data downlink for this satellite.

PacSat is something that I thought was very cool at the time [the first PacSats were launched beginning in 1990](#), but I was unable to set up an Amateur Radio ground station at the time to make use of them. At this stage of my life and Amateur Radio career, I am, and if a PacSat does make it into orbit, I’m going to build a station to be able to access it. Not to mention the potential terrestrial use of this PacSat project.

[AMSAT](#) (or sometimes AMSAT-NA to distinguish it from AMSAT organizations in other countries), was formed in 1969, is so ubiquitous in US Amateur Radio that it’s surprising to learn that its membership is only 4000, of which some are organization. They achieve a lot with this small membership and a surprisingly small budget considering that they’re able to get actual satellites into orbit, which unlike the “good old days” are never completely free now. AMSAT (and all the AMSAT organizations) is an incredible “superpower” for Amateur Radio and I recommend that each (Amateur Radio) reader of Zero Retries seriously consider supporting AMSAT as a member, or perhaps as a significant financial benefactor.

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Repurposed Portable Light Towers for Amateur Radio

By Randy Neals W3RWN / VE3RWN

The reuse of Light Towers for ARES and portable radio ops is brilliant.



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@SelwynTownship

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This morning, @SelwynTownship staff enjoyed a demo from our local Radio Amateurs of Canada section as they tested their equipment throughout the Township. This test was part of the Township's annual training & exercises under the Emergency Management and Civil Protection Act.



1:35 PM · Oct 25, 2023 · 102 Views



Image courtesy of Randy Neals W3RWN / VE3RWN

The photo above is the setup at Selwyn Township [Ontario, Canada] Office for a recent Emergency Management / ARES exercise.

It takes only about 15 minutes to set down the 4 stabilizer jacks, mount the mast and antenna, and crank it up. The height of the tower is approximately 30 feet to the bottom of the antenna.

The Peterborough Amateur Radio Club ARES Team (Peterborough, Ontario) deployed on an ARES exercise recently and used my Doosan (Ingersoll Rand) LS 6kW Light tower to support a VHF/UHF dual band antenna at the Municipal Office/EOC that does not have antennas pre installed.

We haven't yet named our light tower, or given them a cool paint job, but we did buy some reflective tape and dress up our Doosan so it's a bit more visible in the dark. It has the usual Kubota 3 Cylinder Diesel with only 800 hours.

We've already bought a second light tower in an industrial auction and look forward to having 2 at our disposal. This next one is a Wacker Neuson LTN6 with the same Kubota diesel and MECC ALTE generator, but with 8,000 hours. We are likely to strip the Wacker Neuson down to the trailer and tower, remove the diesel and go

battery and solar.

Editor's Note:

W3RWN initially alerted me (I cannot find the reference now with the specifics) that portable “light towers” that used halogen lights and diesel generators were being retired en masse by rental companies and other entities because equivalent units that used solar panels, large (newer technology) batteries, and (much more efficient) Light Emitting Diode (LED) lighting systems were so much more economical to maintain and operate. The retired units are being offered for sale by various auction companies, and are pretty reasonably priced because few people want these “older technology” units. But the value for Amateur Radio Operators is mostly in the trailer plus the push-up / crank-up tower.

I first heard about this concept from a group in Minneapolis, Minnesota, USA, and they have an entire website about it - <https://hamtowertrailers.com/>.

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Recommendations on Inexpensive Generic Data Radios

By Steve Stroh N8GNJ with contributions from Doug Kingston KD7DK, Tadd Torborg KA2DEW, Steven Davidson K3FZT, and Ben Kuhn KU0HN

In Zero Retries 0121, I asked:

Thus, this question - what surplus commercial land mobile radio would you recommend that meets these requirements (in order of preference)...

I received several *excellent* responses.

Doug Kingston KD7DK wrote:

I have been very happy with the Tait 8100/8105 radios. They are designed for external integration. Documentation is excellent (much better than Motorola) and include things like an integration reference if you want to do anything complex. They can be programmed serially or channelized. They have excellent configurability of the accessory connector, including all flavors of audio and GPIO functions. Working with them was a breath of fresh air after dealing with other radios. They have all the bands you are interested in, though the 220 versions are only available overseas where that band has commercial allocations.

<http://repeaterbuilder.com/> has loads of the manuals for this kit.

Tadd Torborg KA2DEW wrote:

I read your requirements and I have never found anything that can do even most of those at once.

My recommendation is to use surplus Kenwood (commercial) radios for your intended purpose. Their attributes:

- Can be retuned to 2m or 440, YES
- Under \$50, YES.
- On eBay, probably not for \$50
- power level at < 5watts. YES

- Flat audio - MAYBE but IF filtering will get you so won't help except at point blank range.
- Freq change remotely - NO

They will do as low as 4 watts, maybe lower if you want. Up to 45 watts for many of them.

The Mic connector is RJ12 or RJ45. Speaker jack is mini plug.

The good radio for 2m right now is the Yeasu FTM3100R at \$150 from Gigaparts, HRO or DxEngineering.

The TYT and whatnot don't have a long enough mean-time-between-failures. Not worth \$50 unless you LOVE doing tech work on the cheapest designed radios on earth. ICs rated for 3.3V but run at 5V, cheapest brand capacitors. Wires too thin for reliability much less for mods. The Chinese brands have a legacy of making equipment in the same factories as the excellent Japanese equipment but with redesigns to save money, cost cutting on everything, including production-final-testing, documentation, support. The firmware is always difficult and is buggy. Why? Yuck.

"Let that be your last Chinese radio".

I'd rather have a 20 year old Japanese model than a brand new Chinese model for the same price.

KA2DEW and I are working out a deal for him to send me a selection of these radios from his existing inventory.

Steven Davidson K3FZT wrote in a comment:

The Kenwood TM-271A is easy to modify for digital modes including flat audio. I've done four of them. But they are going to run you ~\$125 each. Very robust and reliable at 60W. I've not used them at low power other than testing my mod. The TM-281 is a little harder to mod, but seems more available these days.

Ben Kuhn KU0HN wrote in a comment:

I will second the TM-271 and 281. I have modded (if you can even call it that on the 271 since it's just adding a connector) both. I thought the 271 was better overall for data modes. I see them locally every so often for around \$50.

My real suggestion, though, would be the TK-*90 series of Kenwood land mobile radios. I have 3 TK-790s on 2 meters and they are all great. There are two downsides. First, the mic plug is weird and that's how you program them. The second is sometimes there is an internal jumper (0 ohm smt resistor) that needs to be removed to enable the flat audio pin. The connector on the back is a standard db25 cable which makes crimping up a custom cable a breeze. Rob Riggs (the Mobilinkd guy) has a great blog post on sourcing these and using them for data modes. I am highly tempted to get a TK-690 for a 100 watt data radio on 6 meters.

My thanks to KD7DK, KA2DEW, K3FZT, and KU0HN for their recommendations from hands-on experience. As I said in the original request, it's early in my project, but these recommendations give me a better starting point than if I had attempted this from scratch no real idea of where to start looking.

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ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

[Application Period for 2024 ARDC Committees Extended to 2023-11-08](#)

I was asked by ARDC to mention this update to Zero Retries readers. ARDC is still looking for a few more good folks to join their various volunteer committees. The cutoff for applications was originally 2023-10-31 but now has been extended to 2023-11-08. It's a lot of work (at least it was for me on the Grants Advisory Committee), but you really have the potential to make a difference for Amateur Radio as a whole and a lot of your fellow Amateur Radio Operators - worldwide.

Not Everyone is a Fan of Eliminating Symbol Rates in Amateur Radio

[Regarding Report and Order and Further Notice of Proposed Rulemaking WT Docket No. 16-239](#), some observers predicted that there would be some ex-parte pushback filed with the FCC. W. Lee McVey W6EM [wrote](#) (this is just the intro paragraph):

To begin, you have been *duped* by the National Association for Amateur Radio (ARRL) and by the Amateur Radio Safety Foundation (ARSFI) who are the providers of the Winlink radio email service into thinking digital data in our amateur radio world is moving at *less than a snail's pace* and that *flexibility needs improvement*. They assert that by eliminating the *Symbol Rate Roadblock* of 300 baud, it will free amateur radio from [bondage] and allow a *deluge* of new, modern innovation. That's just not so, and I intend to show why not. There's been lots of room for new mode experimentation and development and it has been flourishing. Instead, what is really sought by the above cadre, for the most part, is a means to *open the flood-gates* for radio email use all over high frequency (HF) Amateur Radio Service digital spectrum.

New APRS / SMS Gateway

[From Bill Vodall W7NWP via the NWAPRS mailing list:](#)

FYI.. (from Michael Phelps..)

I'm finding a lot of PNW APRS folks aren't aware that SMSGTE (SMS Gateway) has been gone for almost 2 months.

As such I have created a new service that provides a bidirectional SMS gateway for APRS users using the call SMS. It operates the same as SMSGTE, though it doesn't support some features at this time. So no aliases, however they can be input manually upon request for PNW users!

It does require that SMS end users opt-in. Those not opted in will still receive texts from APRS users.

More details at the link below. Please have all SMS user opt in! As it is a carrier requirement to keep this service running.

W7NWP's message didn't include the link, but a bit of web searching found it easily, thanks to Craig Lamarter KM6LYW's [mention on QRZ](#) and his YouTube video:

Use your radio to send SMS text messages! (New method)

Thanks to Michael Phelps NA7Q, we're back in the APRS Radio-to-SMS business "SMSGTE" is currently offline, so let's use the new "SMS" gateway instead. Two way text messaging between APRS-enabled radios and phones is now simple and easy.

Start here, <http://theconnectdesk.com/SMS>

Be sure to “opt-in” any phone numbers you'll be using.

There's a link to a usage guide on that page.

44Net VPN Servers?

From the October 2023 ARDC Newsletter:

The [ARDC Technical Advisory Committee] has been working on refining 44Net VPN server technology as part of the ARDC PoP project. This resource will allow a ham to quickly request a static IPv4 or IPv6 address and automatically generate Wireguard VPN keys to use with an OpenWRT router. This can be useful for remotely accessing equipment such as a repeater controller, SDR, or RaPi when connected through CGNAT Internet networks. The PoPs are currently set up in Atlanta, Frankfurt, and coming soon to Los Angeles. For more information or to become a beta tester, please email contact@ardc.net.

This is exciting news - that there are actually 44Net VPN servers in development and two such servers are actually online. Experiments about VPN servers as part of 44Net has been mentioned casually, but I don't recall ARDC stating any commitment *to actually deploy VPN servers*. To temper your excitement and / or participation, my experience is that I sent such an email as requested on 2023-07-15 for what ARDC was then calling the **44Net Technology Update**. To date I have not received any response to that email. Hopefully your experience may differ.

GNU Radio Conference 2023 Individual Talks Posted

The individual talks from GRCon23 [have been posted on YouTube](#), including the lightning talks. These are easier to parse out than the livestream recordings posted during the event.

inovato Embraces Amateur Radio (Products)

I first wrote about the **inovato** Quadra “Mini PC” in Zero Retries 0070 when inovato began positioning the Quadra as a replacement for the (then unobtainium) Raspberry Pi as a small inexpensive computing appliance. Then, as now, the Quadra has a lot to recommend it, especially that it's a complete system (includes enclosure, power supply, no SD card needed to boot, etc.)

inovato has recently expanded its product mix for Amateur Radio specifically, including reselling “[AnyTone D878UVII PLUS with USB C charging](#)”. “[HamClock Bundle](#)” is a pretty cool idea as it illustrates nicely the concept of a dedicated computing appliance; just buy this bundle and connect an old DVI5 or HDMI monitor that's been laying around the shack.

Also cool that inovato is based in Portland, Oregon, USA.

digirig Offers Nice Cables for Portable (and Other) Radios



digirig cable for Kenwood TM-V71A - Image courtesy of digirig

I'm on digirig's [mailing list](#) and I'm constantly impressed that they're able to source very nicely made [custom coil cords](#) for various radios that make for a very nice package of the computer, digirig, and radio. digirig's audio interface connector is "TRRS7". digirig has developed a good reputation, and for the size, it's amazing that they've crammed both radio control and an audio interface into such a small package. As a former electronic technician who, for a time, specialized in making cables, nothing I could build would look... and be as reliable, as what digirig offers. It's impressive that not only do they have molded connectors, but also built-in ferrites to minimize inducted noise. The price for two of these cables is \$30 - *well worth that cost*.

[NinoTNC Version Update - x.31](#)

Nino Carrillo KK4HEJ on the Ninotnc mailing list:

About a week ago, I posted firmware versions 3.31 and 4.31 on the flashtnc github page. 3.31 is for 256k dsPICs and 4.31 is for 512k dsPICs.

This new version has bugfixes and some new operating modes, including some using IL2P+CRC (IL2Pc). Notable changes:

- The CSMA logic and DCD coast times are improved for all modes. This reduces collisions on saturated channels, especially between connected BPQ nodes.
- Adds additional BPSK and QPSK modes that are filtered for SSB operation.
- Changes the way the TNC learns its own callsign - now it is read only from UI frames sent by the host. This was done to prevent the TNC from changing its callsign to the host node alias name when inbound L2 AX.25 connections are made using the alias. The TNC uses that learned callsign for its test packets and ID packets in some modes.
- Adds a flash-write time limiter. Only 1 write to flash memory is allowed every 10 minutes. This should be transparent to most users. Flash write is indicated by a quick double-flash of the green RX_PKT LED. It mostly happens when the callsign is saved.
- Adds IL2P+CRC feature. This is a FEC-protected checksum placed after the IL2P packet, in certain modes. The intent of the checksum is to provide a final validity check for the packet after Reed-Solomon decoding. Some users were seeing invalid IL2P packet decodes in very

noisy situations, especially on HF. No change is made to the IL2P packet structure.

Thanks to G4KLX for helping design the IL2P CRC scheme. He's going to integrate it into 4FSK modes he's designing for MMDVM-TNC. I plan to post an updated IL2P description document that describes the CRC in the near future. Packets sent with the CRC are decodable by regular IL2P decoders that know nothing about the CRC. But TNCs operating in IL2Pc mode will filter out packets that don't have the CRC.

TARPN users can update to this version using the 'tarpn flash' utility

I think that the development and “practical use in the field” of Improved Layer 2 Protocol - IL2P (a written from scratch interleaved Forward Error Correction - FEC system) will pay great dividends. It's now available not just for the NinoTNC (both the kit-built and the soon-to-be-shipping assembled versions), the Dire Wolf software TNC, and soon the MMDVM-TNC project. FEC makes a huge difference for the overall reliability, usability, and throughput of data communications.

Leave a comment

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Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out

Join the Fun on Amateur Radio for some pointers.

Zero Retries Frequently Asked Questions (FAQs) — In development 2023-02.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with radio technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to everyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing *Thanks* to:

- Tina Stroh KD7WSF for, well, *everything*!
- **Founding Members who generously support Zero Retries financially:**
 - Founding Member 0000 - Steven Davidson K3FZT
 - Founding Member 0001 - Prefers to Remain Anonymous 01
 - Founding Member 0002 - Chris Osburn KD7DVD
 - Founding Member 0003 - Don Rotolo N2IRZ
 - Founding Member 0004 - William Arcand W1WRA
 - Founding Member 0005 - Ben Kuhn KU0HN
 - Founding Member 0006 - Todd Willey KQ4FID
 - Founding Member 0007 - Merik Karman VK2MKZ
 - Founding Member 0008 - Prefers to Remain Anonymous 14
- Numerous Annual and Monthly subscribers who also generously support Zero Retries financially!

Want to Support Zero Retries?

- The *most* effective way to support Zero Retries is to simply mention Zero Retries to your co-conspirators that are also interested in knowing more about technological innovation that is occurring in Amateur Radio and encourage them to become a fellow subscriber.
- One particularly effective method of promoting Zero Retries is to add a mention of Zero Retries to your [QRZ](#) page (or other web presence) and include a link:

<https://www.zeroretries.org>

- If you'd like to financially support Zero Retries, becoming a paid subscriber is *greatly* appreciated and helps offset expenses incurred in publishing Zero Retries. Paid subscriptions for Zero Retries are *entirely optional*, as explained in this special issue of ZR:
Zero Retries Administrivia - Activating Payment Options.

These blogs and newsletters regularly feature Zero Retries Interesting content:

- [Dan Romanchik KB6NU](#) mentions “Zero Retries Interesting” topics so regularly on his blog (that I otherwise wouldn't know about) that I've bestowed on him the honorific of Pseudostaffer.
- [Jeff Davis KE9V](#) also mentions “Zero Retries Interesting” topics so regularly on his blog (that I otherwise wouldn't know about) that I've bestowed on him the honorific of Pseudostaffer.
- [Amateur Radio Weekly](#) by Cale Mooth K4HCK is a weekly anthology of links to interesting Amateur Radio stories.
- [Experimental Radio News](#) by Bennet Z. Kobb AK4AV discusses (in detail) Experimental (Part 5) licenses issued by the US FCC. It's a *must-read-now* for me!
- [RTL-SDR Blog](#) - *Excellent* coverage of Software Defined Radio units.
- [TAPR Packet Status Register](#) has been published continuously since 1982.
- Other Substack Amateur Radio newsletters recommended by Zero Retries.

These YouTube channels regularly feature Zero Retries Interesting content:

- [HB9BLA Wireless](#) by Andreas Spiess HB9BLA
- [KM6LYW Radio](#) by Craig Lamparter KM6LYW (home of the [DigiPi project](#))
- [Modern Ham](#) by Billy Penley KN4MKB
- [Tech Minds](#) by Matthew Miller M0DQW

Zero Retries is currently using the [Substack email publishing platform](#) to publish Zero Retries. It's particularly suitable for small newsletters as you can get started for no cost.

If you're reading this issue on the web and you'd like to see Zero Retries in your email Inbox every Friday afternoon, just click below to join **1000+** other subscribers:

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If you're a fellow smart person that uses **RSS**, there *is* an **RSS feed for Zero Retries**.

Zero Retries (N8GNJ) is on Mastodon — n8gnj@mastodon.radio — just click:

[Zero Retries / N8GNJ on Mastodon](#)

Email issues of Zero Retries are “instrumented” by [Substack](#) to gather basic statistics about opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- [SuperPacket blog](#) — *Discussing new generations of Amateur Radio Data Communications — beyond Packet Radio (a precursor to Zero Retries)*
- [N8GNJ blog](#) — *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs — Bellingham, Washington, USA*

Thanks for reading!

Steve Stroh N8GNJ / WRPS598 (He / Him / His)

These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham ([The City of Subdued Excitement](#)), Washington, USA, and linked to the Internet via [Starlink Satellite Internet Access](#).

2023-11-03

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Blanket permission granted for TAPR to use any Steve Stroh content for the TAPR Packet Status Register (PSR) newsletter (I owe them from way back).

[1](#)

The “HF” bands still to be considered are actually “Low Frequency - LF” bands.

[2](#)

I only spotted that joke as I proofread it; in fact, these projects, if successful (make it into orbit), will in fact exist in a vacuum - as in absence of atmosphere.

[3](#)

I didn't look that hard, but I did not easily find the hardware details - schematic, bill of materials that would have disclosed the processor and memory details, etc.

[4](#)

I think this is an excellent choice for an educational project if for no other reason than the *stellar support*, including teaching materials, by the Raspberry Pi Foundation.

[5](#)

It's not widely known, but HDMI video is a superset of DVI video, so it's easy to get an HDMI to DVI cable to be able to use an older monitor with a DVI input with a computer that has an HDMI output.

[6](#)

Or *D*igirig - their web page uses both capitalizations.

[7](#)

*T*ip, *R*ing, *R*ing, *S*leeve... basically the 3.5mm analog audio jack (formerly) used on phones.